

# CHEM4021A: ENVIRONMENTAL POLLUTION

---

**Effective Term**

Semester A 2024/25

## Part I Course Overview

**Course Title**

Environmental Pollution

**Subject Code**

CHEM - Chemistry

**Course Number**

4021A

**Academic Unit**

Chemistry (CHEM)

**College/School**

College of Science (SI)

**Course Duration**

One Semester

**Credit Units**

3

**Level**

B1, B2, B3, B4 - Bachelor's Degree

**Medium of Instruction**

English

**Medium of Assessment**

English

**Prerequisites**

Nil

**Precursors**

CHEM2067 Diversity of Life and Evolution or  
BMS2022 Diversity of Life and Evolution or  
BMS1801 Biosphere: Diversity, Functions and Interactions

**Equivalent Courses**

Nil

**Exclusive Courses**

Nil

**Additional Information**

Note: CHEM4021A does not contain any practical component, and has a credit unit value of three (3).

## Part II Course Details

### Abstract

In this course, students will:

- examine problems caused by air, water, waste and land pollution;
- discuss the effects of pollutants on ecosystems and human health;
- be provided with practical experience in the analysis and interpretation of pollutants in the environment;
- develop knowledge and techniques in the monitoring, assessment and control of air, land and water pollution.

### Course Intended Learning Outcomes (CILOs)

| CILOs |                                                                                                                                                                                                                                                                                                                                             | Weighting (if app.) | DEC-A1 | DEC-A2 | DEC-A3 |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|--------|--------|--------|
| 1     | Describe and evaluate the fates and effects of air, water, waste and land-based pollution on ecosystem and human health.                                                                                                                                                                                                                    |                     |        |        |        |
| 2     | Compare and contrast the various laboratory- and field-based techniques used in pollution monitoring for the assessment and control of air, land and water pollution.                                                                                                                                                                       |                     |        |        |        |
| 3     | Critically evaluate, using case studies and via group presentations, environmental and socio-economic issues, including soil erosion, farm animal wastes, pesticides, persistent organic contaminants, fertilizers and acid rain.                                                                                                           |                     |        |        |        |
| 4     | Critically evaluate, using case studies and group presentations, various methods of chemical and biological monitoring, including the use of soils, dust, micro-organisms, bioindicators, plants, animals and human tissues, in the assessment of rivers, coastal waters, groundwater, surface runoff, leachate and air-borne contaminants. |                     |        |        |        |

#### A1: Attitude

Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

#### A2: Ability

Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

#### A3: Accomplishments

Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

### Learning and Teaching Activities (LTAs)

| LTAs |                                                         | Brief Description                                                                                                                                                                                                                                                             | CILO No. | Hours/week (if applicable) |
|------|---------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------------------------|
| 1    | Group activities                                        | Students will learn in student-centric large and small group activities examining various pollutants, emission sources, and contaminant transport and sequestration within environmental compartments.                                                                        | 1        |                            |
| 2    | Group activities and practical sessions                 | Students will learn in student-centric large and small group activities laying the basis for common techniques in environmental monitoring, along with complementary practical sessions where students will be able to experience these techniques themselves under guidance. | 2        |                            |
| 3    | Group activities, written assignments and presentations | Students will learn in student-centric large and small group activities, written assignments, and complementary video presentations related to particular environmental problems.                                                                                             | 3        |                            |
| 4    | Group-based assessments                                 | Students will learn in student-centric large and small group activities, and students will be involved in group-based assessments of real-world pollution problems which they will present to other members of the class.                                                     | 4        |                            |

**Assessment Tasks / Activities (ATs)**

| ATs |                         | CILO No. | Weighting (%) | Remarks (e.g. Parameter for GenAI use)                                             |
|-----|-------------------------|----------|---------------|------------------------------------------------------------------------------------|
| 1   | Assignments and Quizzes | 1, 3, 4  | 50            | Continuous Assessment (50%):<br>- Assignments and Quizzes<br>- Group Presentations |
| 2   | Group Presentations     | 4        |               |                                                                                    |

**Continuous Assessment (%)**

50

**Examination (%)**

50

**Examination Duration (Hours)**

3

**Additional Information for ATs**

Starting from Semester A, 2015-16, students must satisfy the following minimum passing requirement for courses offered by CHEM: "A minimum of 40% in both coursework and examination components."

**Assessment Rubrics (AR)**

**Assessment Task**

Tutorial Assignments and Quizzes

**Criterion**

Understanding of the principles and practice of various aspects of environmental pollution.

**Excellent (A+, A, A-)**

Able to demonstrate excellent understanding of the principles and practice of various topics of environmental pollution.

**Good (B+, B, B-)**

Able to describe and explain the principles of various topics of environmental pollution.

**Fair (C+, C, C-)**

Able to describe and explain some key principles of selected topics of environmental pollution.

**Marginal (D)**

Able to briefly describe isolated principles of selected topics of environmental pollution.

**Failure (F)**

Fail to accurately describe and explain relevant principles of any topics of environmental pollution.

---

**Assessment Task**

Group Presentations

**Criterion**

Demonstration of understanding the principles and practice of the selected topics of environmental pollution, and the ability to present those principles and practice in concise, orderly and professional manners.

**Excellent (A+, A, A-)**

Able to deliver fluent, well-organized and well-prepared presentations to demonstrate excellent understanding of the principles and practice of the selected topics of environmental pollution.

**Good (B+, B, B-)**

Able to deliver fluent presentations, with evidence of proper preparation, to describe and explain the principles of the selected topics of environmental pollution.

**Fair (C+, C, C-)**

Able to deliver presentations, with evidence of proper preparation, to describe and explain some key principles of the selected topics of environmental pollution.

**Marginal (D)**

Able to deliver comprehensible presentations to briefly describe isolated principles of the selected topics of environmental pollution.

#### **Failure (F)**

Fail to present relevant principles of any topics of environmental pollution in coherent and comprehensible manners.

### **Assessment Task**

Examination

#### **Criterion**

Understanding of the principles and practice of various aspects of environmental pollution

#### **Excellent (A+, A, A-)**

Able to demonstrate excellent understanding of the principles and practice of various topics of environmental pollution.

#### **Good (B+, B, B-)**

Able to describe and explain the principles of various topics of environmental pollution.

#### **Fair (C+, C, C-)**

Able to describe and explain some key principles of selected topics of environmental pollution.

#### **Marginal (D)**

Able to briefly describe isolated principles of selected topics of environmental pollution.

#### **Failure (F)**

Fail to accurately describe and explain relevant principles of any topics of environmental pollution.

## **Part III Other Information**

### **Keyword Syllabus**

#### Air Pollution

The structure and properties of the lower atmosphere; air pollution - causes, scales and characteristics; types of atmospheric pollutants. Stationary and mobile sources. Factors important in the removal of atmospheric pollutants. Ozone production in urban air. Acid deposition. Greenhouse effect. Air and water quality: standards, objectives and monitoring. Air pollution in Hong Kong: general features; composition, sources, transformation and removal.

#### Water Pollution

Water quality parameters, classification of water pollutants. Industrial water pollution. Environmental chemistry of industrial pollutants, particularly in the Hong Kong context.

#### Sources, Fates, Effects of Pollutants

Environmental pollutants: their emission, transport and fate. Biological and socio-economic effects of major environmental pollutants. Damage to plants, animals and ecosystems. Problems of soil erosion, farm animal wastes, pesticides and excess fertilizers. Features of contaminated, disturbed and derelict land. Sewage and other pollution related to human/urban activity.

#### Chemical and Biological Monitoring of Pollution

Chemical and biological monitoring. Bioindicators. Uses of soil, dust, microorganisms, plants, animal and human tissues in air monitoring. Establishment of monitoring systems. Sampling and analysis of soil and water. Monitoring of groundwater, surface runoff, leachate and gases from contaminated and disturbed sites.

### **Reading List**

### **Compulsory Readings**

| Title |     |
|-------|-----|
| 1     | Nil |

**Additional Readings**

| Title |                                                                                                                                                                                     |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1     | Connell, D.W., Lam, P.K.S., Richardson, B.J. & Wu, R.S.S. (1999). Introduction to Ecotoxicology. Blackwell Science Ltd., Oxford. 170pp. (Library call number: QH545.A1 I5745 1999). |
| 2     | Online Resources: To be provided, as required, in lectures and tutorials.                                                                                                           |